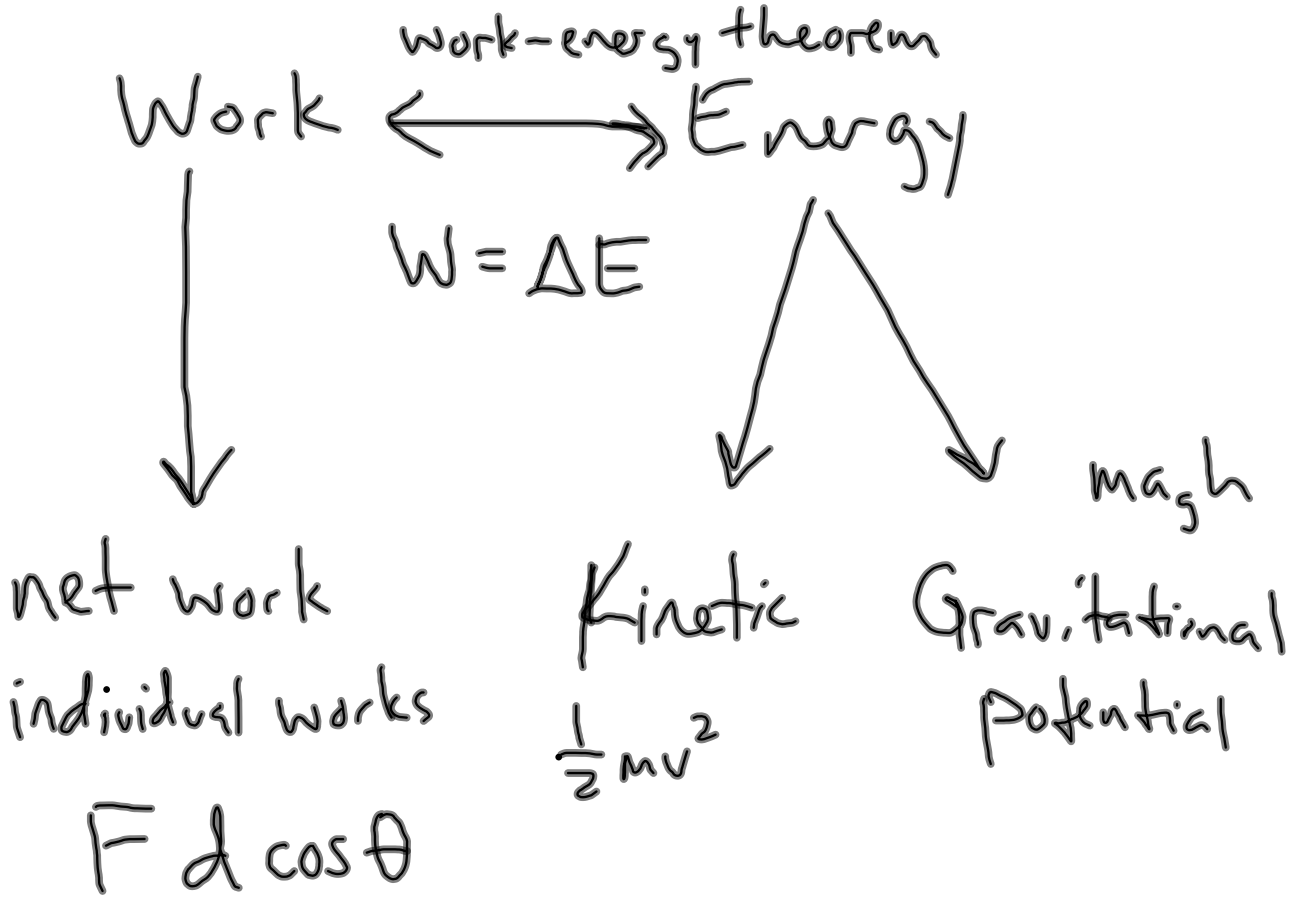
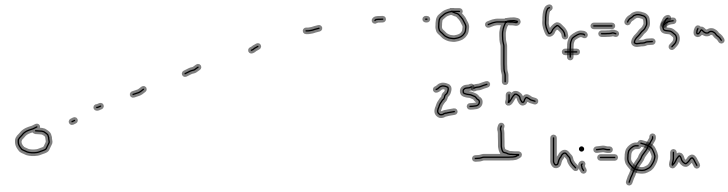


- If the problem mentions force, displacement, and/or work, then work-energy theorem, work, or potentially power calculation.
- If there is no mention of any forces or work, then conservation of energy.

Work and Energy Practice Problems 4.19.12 CP Physics

A pitcher throws a 0.14 kg baseball, and it approaches the bat at a speed of 45 m/s. The bat does 70 J of non-conservative work on the ball as they are in contact. Ignoring air resistance, determine the velocity of the ball after the ball leaves the bat and is 25 m above the point of impact.



$m = 0.14\ kg$ $\quad W = 70\ J$

$V_i = 45\ m/s$ $\quad V_f = ?$

$$W = \Delta E$$

$$= (K_f - K_i) + (U_{gf} - \cancel{U_{gi}}^{\,0})$$

$$W = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mgh_f$$

$$\frac{1}{2}mv_f^2 = W + \frac{1}{2}mv_i^2 - mgh_f$$

$$v_f^2 = \frac{2}{m}\left(W + \frac{1}{2}mv_i^2 - mgh_f\right)$$

$$v_f = \sqrt{\frac{2}{m}\left(W + \frac{1}{2}mv_i^2 - mgh_f\right)}$$

$$= \sqrt{\frac{2}{.14kg}\left[70J + \frac{1}{2}(.14kg)(45\,m/s)^2 - (.14kg)(9.8\,m/s^2)(25m)\right]}$$

$$= 50.3\ m/s$$

Efficiency:

$$\text{Eff} = \left(\frac{\text{final energy}}{\text{initial energy}} \right) 100\%$$

$$= \left(\frac{U_{gf(\text{big ball})} + U_{gf(\text{tennis ball})}}{U_{gi(\text{big ball})} + U_{gi(\text{tennis ball})} \right) 100\%$$